

The Usefulness of Routine Preoperative Chest X-Rays and ECGs: A Prospective Audit

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ABSTRACT

Introduction: Pre-operative Chest X-ray (CXR) and electrocardiograms (ECG) are routinely ordered locally for patients above a certain age. This study examines the usefulness of such a practice and its clinical impact.

Methods: Prospective audit of 875 consecutive anaesthetic patients over a one-month period, assessing the proportion and impact of abnormal CXR or ECG findings.

Results: The proportion of patients with abnormal CXR or ECG increased with worsening ASA status. There was little impact of routine pre-operative CXR and ECG on anaesthetic management. Only 11/324 CXR and 13/375 ECG affected anaesthetic technique or choice of therapeutic procedure.

Conclusion: Targeted investigations should be performed as indicated by clinical findings rather than on the basis of arbitrary age cut-offs.

Keywords: Electrocardiogram, chest X-ray, pre-operative test, audit

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INTRODUCTION

Pre-operative tests are used to detect important illnesses not evident from history and clinical examination alone, to assess the severity of known illness and to identify patients at risk for adverse perioperative events. In local practice, routine preoperative chest X-rays (CXR) and electrocardiograms (ECG) are commonly done for patients over the age of 40 years, even in the absence of any specific indications. This is despite the lack of published evidence demonstrating any benefits from routine testing. The main aim of this audit was to assess the usefulness of routine preoperative ECG and Chest X-rays (CXR), with particular attention to middle aged adults between 40 and 59 years old.

METHOD

We conducted a prospective audit in one hospital over a period of one month, for both inpatient and day

surgery patients. Patients undergoing cardiothoracic surgery and those scheduled for electro-convulsive therapy were excluded, as were patients having surgery under local anaesthesia. Both elective and emergency operations were included. Data regarding patients whose operations were postponed on anaesthetic grounds were also collated. The clinical indices that were studied were: age, gender, ASA status, concurrent illnesses and the nature of surgery (emergency or elective). Data were collected on whether chest X-rays and ECGs were done, the results of these investigations, whether they were indicated or routine and the impact that these results had on perioperative management.

Results were classified as normal, abnormal or missing by the anaesthetists. Chest X-rays were classified as normal if there were no lung, heart or bone abnormalities. ECGs were classified as normal if there were sinus rhythm, no conduction abnormalities and no ischaemic changes. Tests were classified as abnormal, regardless of whether the abnormality was new or old, clinically significant or not. The impact on management of the test was classified "yes" or "no". Where the tests had influenced management, the anaesthetists noted whether this involved: further investigation, in-hospital "blue letter" referral to a specialist physician or surgeon, cancellation or postponement of surgery and modification of anaesthetic of anaesthetic technique or the choice of procedure.

RESULTS

Data were collected on 875 patients out of a total of 1,151 eligible, a return of 76%. All patients were between ASA status 1 to 4, there were no ASA five patients. None of these 875 patients had surgery postponed after preoperative review.

A total of 324 CXRs were done. Of these, 278 were normal, 38 were abnormal and eight were missing. The ASA status of the patients and the CXR results are summarised in Table I. The ASA status and CXR results for patients in the age group 40 to 59 years old are in Table II. None of the ASA I patients in the 40

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Table I. ASA status and CXR results.

	ASA 1	ASA 2	ASA 3	ASA 4
Normal	153	103	19	3
Abnormal	3	13	16	6
Missing	3	4	1	0
Total	159	120	36	9

Table II. ASA status and CXR results in 40 to 59 age group.

	ASA 1	ASA 2	ASA 3	ASA 4
Normal	95	43	3	1
Abnormal	0	2	0	2
Missing	1	1	0	0
Total	96	46	3	3
Not ordered	45	18	2	0
Total patients	141	64	5	3

to 59 age group had an abnormal CXR. Overall, the number of patients with abnormal CXR increased with worsening ASA status, and this correlation was statistically significant on Kendall's tau-b tests ($p < 0.01$). The impact on management of CXR results (whether normal or abnormal) was very low and is shown in Table III. The CXR did not influence the management of three ASA 1 patients who had abnormal CXRs. The impact of the CXR results increased with worsening ASA status and this was statistically significant on Kendall's tau-b tests ($p < 0.01$).

A total of 375 patients had preoperative ECGs. Of these, 285 were normal, 87 were abnormal and four were missing. The ASA status and ECG results of the patients are summarised in Table IV, and for the 40 to 59 age group in Table V. The proportion of patients with abnormal ECGs increased with worsening ASA status from ASA 1 to 3, but not between ASA 3 and 4, and the Kendall tau-b test of correlation was not statistically significant. The impact of these abnormal ECGs is shown in Table VI.

Of the seven ASA 1 patients aged 40 to 59 with abnormal ECGs, only one patient was referred to the cardiologist, who assessed the patient as having no

significant cardiac problem. In the other six patients, no further action was taken based on the ECG. All seven had surgery as planned. Of the 13 ASA 2 patients aged 40 to 59 with abnormal ECGs, no further action was taken in 11 of the patients. The other two patients (both with a prior history of ischaemic heart disease) were referred to cardiologists prior to surgery, and in one patient, there was a change in the anaesthetic plan.

One limitation of the audit was that patients who were assessed preoperatively by the anaesthetists and whose surgery was postponed to after the audit period or cancelled due to abnormal results were not included. This number is less than 20 per month. It was not possible for this audit to include these patients and the impact of their numbers on the results is not known. Further limitations are the lack of information of the exact abnormalities in CXRs and ECGs that were reported as abnormal. Where tests had resulted in further investigations or referrals, it was not known if these had caused delays or postponements.

DISCUSSION

There is little evidence supporting the use of routine investigations in preoperative assessment. Locally, there are guidelines promoting routine investigations and these can have significant impact on practice patterns and attitudes, as well as potential medico-legal implications^(1,2). In this hospital, an arbitrary age limit of 40 years is used, above which patients have routine preoperative ECG and CXR regardless of their health. One reason for this practice is to screen for silent cardiac and thoracic disease that may increase perioperative risk. Another reason is to have a "baseline" for comparison with, should a perioperative complication arise.

Chest X-rays

In this audit, the proportion of ASA 1 patients with abnormal CXR is very low (1.9%), and only slightly higher in ASA 2 patients. Previous studies have shown abnormality rates of 2.5 to 22.5% in ASA 1 and 2 patients⁽³⁻⁷⁾. Furthermore, the CXR finding had

Table III. Impact of abnormal CXR on management.

	ASA 1	ASA 2	ASA 3	ASA 4
Total number abnormal	3	13	16	6
No impact	3	10	10	2
Blue letter	0	1	2	0
Further Ix	0	0	2	0
Impact on Anaesthesia plan or therapeutic procedure	0	2	5	4

Note: Abnormal CXR may result in more than one response.

Table IV. ASA status and ECG.

	ASA 1	ASA 2	ASA 3	ASA 4
Normal	166	93	20	5
Abnormal	17	44	22	4
Missing	1	2	1	0
Total	184	139	43	9

Table V. ASA status and ECG in 40 to 59 age group.

	ASA 1	ASA 2	ASA 3	ASA 4
Normal	112	42	5	2
Abnormal	7	13	0	1
Missing	0	0	0	0
Total	119	55	5	3
Not ordered	22	9	0	0
Total patients	141	64	5	3

little impact on perioperative management across all ASA groups. In none of the ASA 1 and 2 patients was surgery delayed or anaesthetic management modified on the basis of the CXR. Sixty-three ASA 1 and 2 patients aged 40 to 59 years old did not have preoperative CXR, but surgery proceeded nonetheless. The lack of a preoperative CXR appeared to have no impact on management in these 63 patients.

In patients with known cardiac, thoracic or other systemic disease with cardiovascular complications, tests were done to assess the severity and progress of disease. But while the yield of abnormal CXR was higher in ASA 3 and 4 patients, the CXR still had little influence on management. No change in anaesthetic technique was reported for any patient.

Mendelson et al noted the value of preoperative CXR as a baseline for comparison with postoperative CXR⁽⁸⁾. Eighteen percent of their study patients required a postoperative CXR and in half of these, comparison with the baseline was deemed useful. However, the nature of surgery, the clinical status of the patients before surgery and the impact on management of comparison with the baseline was not detailed.

A Royal College of Radiologists study showed only a small impact of abnormal CXR on the

decision to proceed with surgery⁽⁹⁾. The Royal College concluded that routine preoperative CXR had little benefit and was not recommended regardless of age. In contrast, a Swedish study recommends routine CXR in elderly patients (over 70 years old)⁽¹⁰⁾. However, that Swedish study's cohort included a significant number of patients with cardiovascular indication for CXR (73%), and hence only a quarter of the CXR performed would be considered routine. Interestingly a third of these "routine" CXR had abnormal results. Unfortunately, the impact of these abnormalities was not studied further in that paper.

In this audit, the number needed to screen (NNS) to detect an abnormal CXR was 53 in ASA 1 patients, falling to 3 in ASA 3, and 2 in ASA 4 patients. The NNS in ASA 1 patients between 40 and 59 years old was infinity. The impact of abnormal preoperative CXR on subsequent anaesthetic management was also very low in healthy patients. This casts doubts on the need for routine preoperative CXR in healthy patients and questions the rationale of the current age limit of 40 years. The incidence of cardio respiratory disease increases with age, and "yield" can be improved by only doing CXRs when indicated clinically by a history of systemic or cardio respiratory disease that limits daily activity or abnormal physical findings.

Electrocardiograms

Previous studies have found incidences of ECG abnormalities of 4.6 to 16% in routine testing of healthy patients and a higher yield of abnormal ECG with worsening ASA status^(3,5,6,11,12). In this audit, the NNS was 11 in ASA 1 patients and 2 in ASA 3 and 4 patients. In ASA 1 patients 40 to 59 years old, the NNS was 17.

Cardiac disease increases with age, particularly silent ischemia. One study estimated a 25% prevalence of abnormal ECGs by age 57⁽¹³⁾. Hypertension and diabetes were common diseases in our ASA 2 patients and these are associated with increased risk of ischemic heart disease. Comparison with previous ECG has been shown to be the most reliable indicator of acute cardiac disease⁽¹³⁾.

Table VI. Impact of abnormal ECG on management.

	ASA 1	ASA 2	ASA 3	ASA 4
Total number abnormal	17	44	22	4
No impact	16	34	12	2
Blue letter	1	3	9	0
Further Ix	1	3	1	0
Impact on Anaesthesia plan or therapeutic procedure	0	4	7	2

Note: Abnormal ECG may result in more than one response.

Compared to CXRs, ECGs do not incur radiation exposure, are slightly cheaper in our hospital, have a higher yield, and may be the first indicator of heart disease in patients previously thought to be healthy. However, false positives may be further investigated with invasive tests, subjecting the genuinely healthy patient to unnecessary risks and costs.

The impact of ECG on management is a better indicator of the benefit from routine ECG rather than the abnormality rate. In this audit, the impact on management was very low in ASA 1 and 2 patients. The range in other studies was reported to be from 0 to 0.9% of patients tested^(3,5,6). The positive predictive value of ECGs in these patients has been estimated at 4%, but the positive predictive value from history and examination alone is 2%, making any gain from ECGs small⁽⁵⁾. Unfortunately, information on the specific abnormality on the ECG was not collected in this audit, but these may have been minor abnormalities such as a solitary ventricular ectopic beat or marginally increased PR intervals, which were unlikely to impact on management.

The costs of routine preoperative investigations can be significant. ASA 1 patients aged 40 to 59 comprised 16% of our audit returns. We estimate that 2,480 such patients are anaesthetised annually in our hospital. There are also time and efficiency costs involved in ordering tests, transporting patients, carrying out tests, waiting for and tracing results. Patients with significant disease for whom tests are truly indicated may be affected by the workload of these routine tests. Even if each investigation had a specificity of 95%, 9% of healthy patients can be expected to have at least one abnormal result with two tests. Abnormal results in healthy patients may be investigated and "treated" unnecessarily.

In conclusion, this audit suggests that routine preoperative CXR and ECG in healthy ASA 1 patients, especially in the 40- to 59-year-old age group, should

be reconsidered. The detection of abnormalities was low, and their influence on anaesthetic management was minimal. Guidelines based on an arbitrary age limit may make administration easy, but should not be a substitute for clinical judgment. Individual hospitals will have to decide what abnormality detection rates and clinical impact justify preoperative CXR and ECG, while taking into account economic and legal concerns.

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